TITLE

Device for ventilation of a vehicle seat.

TECHNICAL FIELD

The present invention relates to an arrangement for ventilation of a vehicle seat, which arrangement comprises an air-distributing material and an electric heating element comprising at least one electrically conductive component arranged in a pattern in conjunction with at least one support, where the vehicle seat comprises a bottom part which is adapted for ventilation by blowing air in or sucking air out via at least one passage through the bottom part and on through the said air-distributing material.

In particular, the invention finds application in connection with ventilation of seats intended for people travelling in a vehicle.

BACKGROUND ART

For reasons of comfort and safety, ventilation and temperature-control of seats is utilized in vehicles, for example. Both the driver's seat and the other vehicle seats can then be adapted for ventilation by blowing air in or sucking air out by means of a fan. In the case of air being blown in, this supplied air is guided through the seat and out towards the person sitting in the seat concerned. In the case of air being sucked out, this sucked-out air is guided in through the seat from the person sitting in the seat concerned. Temperature-control of the seat can moreover be effected by heating the seat by means of a separate, electrically heatable heating element. The heating element consists of electrically conductive elements which are arranged in a suitable configuration. For example, the said elements consist of electrically conductive resistance wires which are arranged in the form of a heating coil in the seat concerned. The wires are suitably attached to a supporting material, for example foamed polyurethane. The wires can also be placed between two material layers, of foamed polyethylene for example, where at least one layer serves as a supporting material by virtue of the

wires being attached to it. In this way, the wires are protected from wear from both above and below. Moreover, an arrangement is obtained in this way where the electrically conductive wires are fixed in a desired configuration, so that, for example, undesirable conductive patterns and possible electric short-circuit can be prevented. By virtue of the heating element being connected to a power supply unit which delivers power, the heating element can be heated to a suitable temperature.

Both the driver's seat and the other vehicle seats can also be adapted so that they can be cooled by supplied blown-in air which is in turn cooled by means of a separate cooling device, for example in the form of what is known as a Peltier element. In some cases, however, it may be more pleasant and effective to provide ventilation using air which is sucked from the person sitting in the seat, which air is guided on down through the seat. In this case, no separate cooling device is used. Ventilation of seats in vehicles can therefore be effected by devices for both blowing air in and sucking air out.

Modern seats are normally manufactured by what is known as cold-foaming, which is a previously known manufacturing method for producing soft, elastic foam plastic. The material for the ready-moulded component which is used as the bottom part or the back part is called comfort foam. The shaping tool used in the cold-foaming process is preferably designed so that "trenches" are formed in the comfort foam when it is moulded. These trenches are relatively narrow recesses in the comfort foam, "rods", that is to say thin shaped metal bars on the lower side of the cover, being used for holding interacting fastening means arranged in the bottom of the trench concerned. The purpose of this arrangement is to secure the cover, which is guided down into the trenches and is fixed there with the aid of the rods. In this way, the cover is tightened against the bottom part.

The air blown in or sucked out is distributed via one or more openings which are formed in the comfort foam. This opening has a certain depth and a certain shape, for example circular or square. The opening communicates with a fan which is suitably located on the lower side of the seat concerned and can then be adapted to blow air in or suck air out via at least one passage formed in the comfort foam. In the case of air being blown in, the said cooling element can be located upstream or downstream of the said fan. Like the trenches, the opening is preferably formed in the foam plastic of the seat by virtue of the shaping tool used in the cold-foaming process being designed so that the said opening is formed in the comfort foam when it is moulded. Arranged above the opening, possibly covering the entire bottom part, is an air-distributing material which preferably has a porous fibrous structure and is made of relatively thin fibres which are relatively sparsely arranged in an asymmetrical three-dimensional network structure so that distribution of air supplied to the fibre network takes place. This air-distributing material is not compressed appreciably when someone sits in the seat, and so its functioning is not then affected appreciably in this state. The air-distributing material also allows airflow both along and across the main extension of the bottom part, and airflow in directions lying in between. The back part of the seat can also have a similar construction.

When a vehicle seat is assembled, an air-distributing material as above is therefore arranged on the comfort foam so that the air-distributing material at least covers the opening or the openings present in the comfort foam. Arranged on top of the air-distributing material is a heating coil, suitably one with its wires located between two protective material layers as described above. A suitable cover is then attached to the seat. Additional padding material may be inserted between the cover and the heating coil.

A particular circumstance which can constitute a problem is that the abovementioned type of seat comprises a number of material layers between the comfort foam and the cover in order to bring about the desired functions

of effective ventilation and effective heating. This can in turn involve a time-consuming and expensive manufacturing procedure and result in a high price of the finished product.

US 6003950 discloses a ventilation system in a vehicle seat. The air is sucked into a passage in the seat through the covering of the seat by means of a fan. The covering of the seat consists of an outer layer and an inner layer. The air also passes a layer comprising electric heating wires located on a perforated plastic material and a further underlying layer of air-distributing material as well.

Furthermore, patent document US 6064037 discloses a device to be used for heating a vehicle seat. The device comprises an air-distributing material and a heating element which are arranged together.

The said document discloses how a number of different layers are used in the seat structure in order to obtain the desired functions of effective ventilation and effective heating.

A particular problem which exists in connection with heated and ventilated vehicle seats is the need to provide a cost-effective and compact delivery unit intended for mounting in a seat in connection with manufacturing a vehicle.

DISCLOSURE OF INVENTION

A primary object of the present invention is to provide an improved seat structure in which the abovementioned problems are solved, in particular the number of component layers being reduced (in relation to known art) while functionality is retained.

This object is achieved with an arrangement according to Patent Claim 1 below, that is to say an arrangement as described in the introduction, which

is characterized in that the said support, heating element and air-distributing material are manufactured as an integrated arrangement adapted for mounting in conjunction with the said vehicle seat, the said air-distributing material being designed as at least one unit which is dimensioned for mounting in a correspondingly designed cutout in the vehicle seat.

Examples of advantages which are obtained with the present invention are cost-effective manufacture and simpler construction of a vehicle seat compared with previously known art. A particular advantage of the invention is that it can be implemented in the form of a single delivery unit which includes all the parts required for mounting in a seat, that is to say a heating element, a suitably designed air-distributing material and a support for these components. In this way, a complete, integrated delivery unit is obtained, which can be mounted in a seat during a vehicle manufacturing process. A further advantage of the invention is that this integrated delivery unit can be attached to the upper side of a seat in a simple and effective way.

It should be noted in particular that when support, heating element and air-distributing material are manufactured as an integrated arrangement adapted for mounting in conjunction with a vehicle seat, these can be designed so that the support and the air-distributing material consist either of two separate units or of one and the same unit. In the latter case, the air-distributing material is itself so rigid and strong that it can act as a support and bear the heating element. The integrated arrangement therefore comprises an air-distributing material and an electric heating element arranged in conjunction with a support which can either consist of a separate part or be the same as the air-distributing material.

In the embodiments below, which exemplify the invention, the inventive idea is shown in a few applications. In all these cases, however, the integrated unit includes air-distributing material, electric heating element and support. Whether the support and the air-distributing material consist of one and the

same unit or two separate units, the integrated unit will therefore comprise on the one hand an electrically conductive component arranged in conjunction with a support and on the other hand an air-distributing material.

DESCRIPTION OF FIGURES

The invention will be described below in connection with preferred illustrative embodiments and the accompanying figures, in which:

Figure 1 is a perspective view of a vehicle seat according to the invention;

Figure 2 is a perspective view of the bottom part of a vehicle seat;

Figure 3 is a perspective view of a heating coil intended for a vehicle seat;

Figure 4 is a partly cutaway perspective view of the bottom part of a vehicle seat according to a first embodiment of the invention;

Figure 5 is a sectional view of the bottom part of a vehicle seat;

Figure 6 is a perspective view of a heating coil and air-distributing material intended for a vehicle seat according to a second embodiment of the invention;

Figure 7 is a partly cutaway perspective view of the bottom part of a vehicle seat according to a second embodiment of the invention;

Figure 8 is a partly cutaway perspective view of the bottom part of a vehicle seat according to a third embodiment of the invention;

Figure 9 is a sectional view of the bottom part of a vehicle seat according to a variant of the embodiments above;

Figures 10a-b are perspective views of the bottom part of a vehicle seat;

Figure 11 is a perspective view of an alternative embodiment of the invention, and

Figure 12 shows a manufacturing method for an arrangement according to the invention.

PREFERRED EMBODIMENTS

Figures 1-3 show components which are used in the present invention but which are previously known per se.

The area of application of the invention is preferably in connection with a vehicle seat, which, in accordance with Figure 1, consists of a seat 1 comprising a bottom part 2 and a back part 3. The description below relates to the bottom part 2, but the configuration according to the following description can also be applied to a back part 3 belonging to the seat 1.

The said bottom part 2 is normally manufactured by what is known as cold-foaming, which is a previously known manufacturing method for producing soft, elastic foam plastic. Cold-foaming is commonly used in the manufacture of padding material for cushions, mattresses etc. and is based on certain predetermined components being mixed and reacting together so that foaming takes place. The reaction takes place at a relatively low temperature, suitably in a specially designed shaping tool. In the cold-foaming process, a "fermentation" takes place, by virtue of which the finished plastic material is formed in the mould. The ready-moulded component is called comfort foam 2'.

For increased comfort, the bottom part 2 is equipped for ventilation and temperature-control. Both the driver's seat and the other vehicle seats can then be adapted for ventilation by blowing air in or sucking air out, preferably sucking it out, which will be the variant described below. The air sucked out is guided via at least one cutout or opening 4 which is formed in the bottom part. The air sucked out is guided from an area on the upper side of the bottom part 2, that is to say around the area close to the person sitting in the seat concerned, and on in through the bottom part 2 via the opening 4.

Located at least above the opening 4, and preferably made so that it fits in the opening, is an air-distributing material 5, as shown in Figure 2, which material 5 has a porous fibrous structure and is made of relatively thin fibres which are relatively sparsely arranged in an asymmetrical three-dimensional network structure so that distribution of air supplied to the fibre network takes place.

As shown in Figure 2, the air-distributing material 5 constitutes a layer comprising an upper side 5' and a lower side 5", which are essentially parallel and separated by the thickness d of the material. This air-distributing material 5 is not compressed appreciably when someone sits in the vehicle seat, and so its functioning is not then affected appreciably. Use is suitably made of a material called spacer material, but various types of material can be used within the scope of the invention. A material is suitably selected in which the fibres have such resilience that the shape of the material is essentially maintained when it is subjected to loading. The fibres should not be brittle either, so that they break when they are subjected to loading, but should be elastically resilient, so that the deformation the material undergoes when it is subjected to loading is reversed when the loading is removed. The air-distributing material 5 also allows airflow both along and across the main extension of the bottom part 2, and airflow in directions lying in between. In brief, when the expression "air-distributing material" is used below, it means in this context that the material 5 concerned has certain properties, primarily

that it is essentially incompressible when a person travelling in the vehicle has sat down in the seat, and also that the material 5 allows air to be guided at least in a direction essentially along the plane in which the air-distributing material 5 is oriented.

Temperature-control of the bottom part 2 can be effected in the form of cooling of the air supplied and/or by means of heating the bottom part with the aid of a separate, electrically heatable heating element 6 (see Figure 3). The heating element 6 comprises in a way which is previously known per se a pattern of electrically conductive elements which, according to the embodiment shown, consist of electrically conductive resistance wires 7 in the form of a heating coil. However, the invention is not limited to only this embodiment, but the electrically conductive elements can alternatively consist of other forms of electrically conductive element, for example carbon fibre wires. Nor do the electrically conductive elements have to be run in such a configuration as is shown in Figure 3, that is to say in the form of a regular coil, but they can alternatively be run in a different pattern, for example in a grid or in the form of a number of essentially parallel wires.

By virtue of the heating element 6 being connected to a power supply unit 8 which delivers power, the heating element 6 can be heated to a suitable temperature. The heating element 6 also comprises a temperature sensor 23 of a kind known per se, which is connected to the power supply unit 8. The temperature in proximity to the heating element 6 can be detected by means of the temperature sensor 23. In this way, regulation of the temperature of the heating element 6 is made possible, depending on the actual temperature and set desired values relating to the desired temperature for the seat concerned. This type of temperature-dependent heat regulation is previously known per se and is therefore not described in detail here.

According to a first embodiment of the invention, shown in Figures 4-5, in which the integrated arrangement comprises support 9, heating element 6

and air-distributing material 5, the support 9 and the air-distributing material 5 consist of two different units.

According to the present invention, the resistance wires 7 of the heating element are arranged in conjunction with the air-distributing material 5, according to a first embodiment as shown in Figure 4. Here, the resistance wires 7 are attached to the lower side of a support 9, that is to say that side of the support 9 which faces the comfort foam 2'. The support consists of a thin layer of relatively uniform thickness of foamed polyurethane or similar soft flexible material. The opening 4 of the comfort foam 2' is adapted for mounting a layer of air-distributing material 5, the main extension plane of which layer on the whole coincides with the main extension plane of the comfort foam 2'. The support material 9, to which the resistance wires 7 are attached, is placed on this layer, so that the resistance wires 7 come into contact with the air-distributing material 5 and the support material 9 will face essentially upwards, away from the comfort foam 2'. In this connection, the main extension plane of the support material 9 will on the whole coincide with the main extension plane of the comfort foam 2'.

In accordance with Figure 5 in particular, which shows the invention in a dismantled state, the support material 9 has an extent which slightly exceeds the extent of the air-distributing material 5 and the dimensions of the cutout 4. This means that the air-distributing material 5 and the support material 9 with associated resistance wires 7 will form a unit which is inserted into and mounted in the opening 4. By virtue of the support material 9 having an extent which exceeds the extent of the opening 4, an edge portion 9a (cf. also Figure 4) of the support material 9 is defined in this way, which extends over the gap which is formed between the outer edge of the air-distributing element 5 and the corresponding inner side 4a of the opening 4 (cf. Figure 5) in the comfort foam 2'. This edge portion 9a then has two functions. One function is that it constitutes an edge strip, by means of which the support material 9 can be fixed to the upper side of the comfort foam 2' by virtue of

the said edge portion 9a being designed with means for anchoring the support 9 to the said seat 1. This can in turn be implemented by the lower side of the edge portion 9a being coated with suitable means for attaching the edge portion 9a to the upper side of the comfort foam 2', for example a suitable glue. It will of course be clear to the expert that there are a large number of different ways of anchoring the support 9 to the said seat 1, for example by sticking, nailing, screwing, attaching with clips, fusing materials and similar methods. The other function of the edge portion 9a is that it overlaps the abovementioned gap between the outer edge of the air-distributing element 5 and the corresponding inner edge 4a of the opening 4, so that the said gap is sealed for the passage of air, if not completely then at least to a very great degree.

One advantage of the present invention is that the support element 9 with resistance wires 7 and air-distributing element 5 can be manufactured as a single integrated unit which is ready for delivery and subsequent mounting in a seat. This is in turn made possible by the heating element 6 with the resistance wires 7 (or other suitable electric element) first being mounted on the support material 9, suitably by means of gluing. The unit formed (consisting of resistance wires 7 and support material 9) is then joined together with the air-distributing material 5. During joining together, it is ensured that the abovementioned edge portion 9a of the support material 9 is defined. In this way, an integrated arrangement is formed, which can be delivered as a single delivery unit and mounted in an opening 4 as can be seen from Figure 4. By virtue of the support material 9 being larger than the opening 4, the edge portion 9a can finally be fixed to the upper side of the comfort foam 2'.

In order to illustrate clearly the construction of the invention, dashed arrows indicate in Figure 2 on the one hand how the support material 9 is attached to the air-distributing material 5 (the resistance wires 7 being arranged between the support material 9 and the air-distributing material 5) and on the

other hand how the edge portion 9a of the support material 9 is attached to the upper side of the comfort foam 2'.

After the support material 9 has been secured, the desired cover 10 is fitted on the bottom part, the cover 10 being tightened against the bottom part 2, to be precise in "trenches" 11, 12 which are formed in the comfort foam 2'. The shaping tool used in the cold-foaming process is preferably designed so that the said trenches 11, 12 are formed in the comfort foam 2' when it is moulded. These trenches 11, 12 are relatively narrow recesses in the comfort foam 2', at the bottom of which "rods" (not shown), that is to say thin, shaped metal bars arranged on the lower side of the cover 10, are used for holding with interacting fastening means 13 (shown diagrammatically as a partly dashed line in Figure 4) in the trenches 11, 12. The cover 10 is therefore guided down into the trenches 11, 12 and is there attached to fastening means 13 with the aid of the rods. In this way, the cover 10 is tightened against the bottom part 2.

With reference to Figure 5, the opening 4 in the comfort foam 2' has a certain depth h and a certain shape, for example circular or square. The opening 4 communicates with a fan 14 which can blow air in or suck air out via at least one passage 15 formed in the comfort foam 2'. Use is suitably made of a number of passages 15, which is also shown in Figure 5. The fan 14 is preferably of the centrifugal fan type and, according to the invention, is of the type which sucks air from an area on the upper side of the comfort foam 2', through the passages 15 and out via the fan 14. Like the trenches 11, 12, the opening 4 is preferably formed in the comfort foam 2' by virtue of the shaping tool used in the cold-foaming process being designed so that the said opening 4 and the trenches 11, 12 are formed in the comfort foam 2' when it is moulded.

According to a second and third preferred embodiment, shown in Figures 6-8, the support 16, 17, 18 consists of air-distributing material. According to the

second embodiment, shown in Figures 6-7, the said electrically conductive component 7 is attached between supports consisting of a first layer 16 and a second layer 17 of air-distributing material. According to the third embodiment, shown in Figure 8, the said electrically conductive component 7 is located inside a support consisting of a layer 18 of air-distributing material. These embodiments will be described in greater detail below.

According to the second embodiment, as shown in Figure 6, the resistance wires 7 are attached between supports consisting of a first layer 16 and a second layer 17 of the air-distributing material mentioned previously. With reference to Figure 7, the layers 16, 17 are placed in the opening 4 so that their main extension plane on the whole coincides with the main extension plane of the comfort foam. In this connection, the heating wires are attached to the first layer 16 or the second layer 17 of the air-distributing material, or to both 16, 17. In this embodiment, use is therefore made of only the air-distributing material as a support, and no other separate support materials are employed. Otherwise, the bottom part 2 is assembled in the same way as the first embodiment.

According to the third embodiment, as shown in Figure 8, the resistance wires are incorporated within a layer 18 of the air-distributing material. The resistance wires 7 are preferably integrated with the air-distributing material when the air-distributing material is manufactured. The air-distributing material 18 and the resistance wires 7 incorporated in it are placed in the opening 4 so that their main extension plane on the whole coincides with the main extension plane of the comfort foam 2'. In this embodiment, use is therefore made of only the air-distributing material 18 as a support, and no other separate support materials are employed. Otherwise, the bottom part 2 is assembled in the same way as the first embodiment.

For the abovementioned embodiments, the appearance of the passage where the air is guided into the comfort foam can take many forms. As

shown in Figure 9, it is possible to position a presence sensor 19 of known type in the comfort foam 2', the purpose of which presence sensor 19 is, for example, to detect whether or not an airbag located in proximity to the vehicle seat concerned is to be switched in. If, for example, a backward-facing child seat (not shown) is placed in the vehicle seat, it is not desirable for such an airbag to be activated if a collision should occur. Such a presence sensor 19 can advantageously also be used in order, where appropriate, to activate a reminder signal for seat belt use.

When such a presence sensor 19 is positioned between the fan 14 and the opening 4, it is necessary for the airflow to be guided past the presence sensor 19 in a suitable way. A by-pass passage 20 in accordance with Figure 9 is a suitable solution. This passage can be rectangular with a long, narrow cross section but can also have other cross sections.

The invention can therefore be applied to an arrangement as above with an airflow passage 20 which is guided past a presence sensor 19 through a by-pass.

For all the embodiments above, the resistance wires 7 can be fastened to the support material 9, 16, 17 concerned by being attached by gluing, for example, the glue being applied in such a way that it follows the path of the resistance wires 7 and does not therefore impede the airflow unnecessarily.

With reference to Figures 10a and 10b, the opening 4 can be arranged so that it is more integrated with the trenches 11, 12, 21, 22, 23, 24, so that these are given an extension which to a greater extent runs towards the central part of the comfort foam 2'. The cover can then be attached in a more satisfactory way. In these cases, the opening 4 will have a more irregular shape, a shape which will also apply for the air-distributing material (not shown) and, where appropriate, the support material for the resistance wires (not shown) as well. With reference to Figure 10c, it is also possible for a

number of openings 25, 26 to be present, use then being made of a number of air-distributing materials (not shown) and, where appropriate, support materials for the resistance wires (not shown), which fit in the openings 25, 26.

Furthermore, as mentioned previously, the embodiments above can also be applied to a back part 3 belonging to the seat 1, which part, in accordance with Figure 1, can also be adapted for ventilation by blowing air into or sucking air out from at least one air-distributing opening 30.

Figure 11 shows a further embodiment of the invention, which shows that it can be designed with a layer of a support material 9 which in turn bears on its underside electrically conductive elements 7, suitably in the form of resistance wires, forming part of a heating element of the kind mentioned above. The resistance wires 7 are in turn connected to a power supply unit 8.

According to the embodiment, the support material 9 also bears two different units of air-distributing material 5, which are dimensioned so as to fit in two corresponding openings 4 in the comfort foam 2' of the seat concerned. In a similar way to above, the support material 9 is designed so that it overlaps the gaps which are formed between each unit of air-distributing material 5 and the respective opening 4. In this way, an edge portion 9a of the support material 9 is defined, which is used in order to seal this gap and to attach the support material 9 (and therefore the whole unit comprising air-distributing material 5 and resistance wires 7) to the comfort foam 2'. In a similar way to above, the comfort foam 2' has a number of passages 15 formed in each opening 4 for feeding air through the seat.

The invention is not limited to one or two units consisting of air-distributing material but can in principle be implemented with any number of units of air-distributing material, which can all then be mounted on the lower side of the support material.

Figure 12 shows diagrammatically a manufacturing process for assembling an integrated unit according to the invention. Figure 12a shows how a glue strand 27 is applied to the lower side of a support material 9 (cf. Figures 4 and 5, for example). The positioning of the glue strand 27 corresponds to the positioning of a resistance wire (not shown in Figure 12a).

The next step in the manufacturing process is to apply the resistance wire 7 to the glue strand 27 on the support material 9. Figure 12b shows the unit after the resistance wire 7 with its connections (for connection to a power supply unit) has been applied to the glue strand.

The next step is to apply glue to the lower side of the support material 9 and the resistance wire 7 as preparation for mounting one or more units of air-distributing material. This glue layer is shown in Figure 12c as a number of areas 28a, 28b, 28c on the lower side of the support material 9. For the sake of clarity, the resistance wire 7 is not shown in Figure 12c.

According to a particular embodiment of the invention, which can be seen from Figure 12d, certain selected areas on the lower side of the support material 9 can be provided with a separate applied material layer 29, which can consist of, for example, an extra thick glue layer or alternatively a thin layer of fabric, felt or the like. The positioning, dimensions and thickness of this additional material layer 29 are then selected according to particular wishes for guiding the airflow through the seat concerned. The additional material layer 29 then defines an airflow-guiding layer which can be used for, for example, limiting the flow of air passing through in that area of the seat which corresponds to the positioning of the material layer 29. The degree of air-permeability can then be controlled by the thickness selected for the said material layer 29. To the extent that the additional material layer 29 consists of glue, the airflow in the area concerned can then be limited depending on how thick this material layer 29 is made.

Figure 12e shows finally how a unit of air-distributing material is glued firmly to the lower side of the support 9. For the sake of clarity, the resistance wire 7, the glue layers 28a, 28b, 28c and the additional material layer 29 are not shown in Figure 12e.

The invention is not limited to what is indicated above, but different embodiments are possible within the scope of the patent claims. For example, some form of additional padding can for reasons of comfort be applied on top of the arrangement according to the invention before the cover 10 is fitted. Furthermore, for example, a thin protective material layer can be present between each unit of air-distributing material 5 and the abovementioned resistance wire 7, that is to say the resistance wires 7 do not have to be in direct contact with the air-distributing material 5 as shown in Figure 4 for example.

The invention is suitably applied in connection with vehicle seats, but other types of seat may also be appropriate.